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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/646,014	08/22/2003	Peijun Ding	AM-6265.D1	8981

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Applied Materials, Inc.  
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EXAMINER

VERSTEEG, STEVEN H

ART UNIT

PAPER NUMBER

1753

DATE MAILED: 05/11/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/646,014

Applicant(s)

DING ET AL.

Examiner

Steven H VerSteeg

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 03 December 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 22 August 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 12/3/03.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Double Patenting*

1. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

2. Claims 1, 5, 9-11, and 15-18 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 5, 8, and 9 of U.S. Patent No. 6,610,184 B2 in view of US 5,178,739 to Barnes et al. (Barnes).

3. For claim 1, Applicant requires a sputtering process comprising in a plasma sputter reactor having a chamber arranged about a central axis a target comprising a material to be sputtered and a pedestal for supporting a substrate in opposition to the target along the central axis across a processing space: impressing a DC magnetic field of a first magnetic polarity parallel to the central axis in a half of the processing space closer to the pedestal; injecting a sputter working gas into the chamber; electrically biasing the target to excite the working gas into a plasma to thereby sputter the material of the target; and RF biasing the pedestal to create a negative DC bias on the pedestal.

4. For claim 11, Applicant requires a plasma sputter reactor comprising a vacuum chamber with sidewalls arranged around and substantially parallel to a central axis, a pedestal for

supporting a substrate in the chamber, a sputtering target positioned in opposition to the pedestal along the central axis with a processing space being defined in a region between the pedestal, target, and sidewalls, a magnetron positioned on a side of the target opposite the processing space, auxiliary magnets disposed at least partially around the processing space adjacent to the sidewalls and having a first magnetic polarity extending parallel to the central axis and a coil wrapped around the processing space configured to inductively couple RF power into the chamber.

5. The patent claims a plasma sputter reactor comprising a vacuum chamber with sidewalls arranged around and substantially parallel to a central axis (claim 1, lines 1-3); a pedestal for supporting a substrate in the chamber (claim 1, lines 4-5); a sputtering target positioned in opposition to the pedestal along the central axis with a processing space being defined in a region between the pedestal, target, and sidewalls (claim 1, lines 6-9); a magnetron positioned on a side of the target opposite the processing space (claim 1, lines 14-15); and auxiliary magnets disposed at least partially around the processing space adjacent to the sidewalls and having a first magnetic polarity extending parallel to the central axis (claim 1, lines 16-19). The auxiliary magnets are in a half of the processing space closer to the pedestal (claim 8).

6. The patent does not claim a coil wrapped around the processing space in addition to the auxiliary magnets, a method of using the apparatus, or RF bias to the pedestal.

7. Barnes discloses that an RF coil in a chamber is beneficial to sputtering because it helps ionize sputter neutrals and cause the plasma to be more evenly distributed in the chamber (col. 2, l. 59-63). Barnes also discloses RF biasing the substrate to control the amount of resputtering

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into vias (col. 4, l. 58-64). Barnes also discloses that sputtering apparatus can be used in a sputtering process.

8. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the invention of the patent to include an RF coil because of the desire to have the plasma more evenly distributed in the chamber.

9. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the invention of the patent to use the apparatus in a process because of the desire to process a substrate.

10. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the invention of the patent to apply an RF bias to the substrate to control the amount of resputtering into vias.

11. For claim 5, Applicant requires inductively coupling RF power into the chamber. As noted above, the limitation is obvious in light of Barnes.

12. For claims 9 and 15, Applicant requires the magnetron to be rotatable about the central axis and to comprise an inner pole having a second magnetic polarity extending parallel to the central axis and producing a first integrated magnetic flux and an outer pole having a third magnetic polarity opposite the second magnetic polarity and producing a second integrated magnetic flux. The patent discloses the limitation (claim 9)

13. For claim 16, Applicant requires the second integrated flux to be at least 50% greater than the first integrated flux. The patent discloses the limitation (claim 9).

14. For claims 10 and 17, Applicant requires the first and third magnetic polarities to extend along a same direction. The patent discloses the limitation (claim 5).

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15. For claim 18, Applicant requires the auxiliary magnets to produce a magnetic field extending along the central axis in a half of the processing space adjacent the pedestal. The patent discloses the limitation (claim 8).

16. Claims 2-4, 6-8, and 12-14 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 1 of U.S. Patent No. 6,610,184 B2 in view of US 5,178,739 to Barnes et al. (Barnes) and US 6,080,285 to Liu et al. (Liu).

17. For claims 2, 6, and 12, Applicant requires the target to comprise copper. For claims 3, 7, 13 and 14, Applicant requires the target to comprise tantalum. For claims 4 and 8, Applicant requires a nitride of tantalum to be sputter deposited on the substrate. The patent does not claim the target material. Barnes already makes it obvious to have a coil. Liu discloses that when making an integrated circuit, copper, tantalum, and tantalum nitride are common sputtering target materials (claim 25).

18. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the invention of the patent to sputter copper, tantalum, or tantalum nitride because of the desire to form an integrated circuit.

*Claim Rejections - 35 USC § 112*

19. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

20. Claims 5-8 and 11-18 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which

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was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. In claim 5, Applicant requires "inductively coupling RF power into said chamber." In claim 11, Applicant has claimed "auxiliary magnets disposed at least partially around said processing space adjacent to said sidewalls and having a first magnetic polarity extending parallel to said central axis; and a coil wrapped around the processing space configured to inductively couple RF power into said chamber." There is no location in the specification of the instant application or the parent application where there is a disclosure of the use of both auxiliary magnets and a coil. There is certainly disclosure of the use of either the auxiliary magnets or the coil, but there is no disclosure of the use of both as is currently claimed. As such, the subject matter is considered to be new and must be canceled.

21. Claims 6-8 depend from claim 5 and contain all of the limitations of claim 5. Therefore, claims 6-8 are rejected for the same reasons as claim 5. Claims 12-18 depend from claim 11 and contain all of the limitations of claim 11. Therefore, claims 12-18 are rejected for the same reasons as claim 11.

*Allowable Subject Matter*

22. Claims 1-4, 9, and 10 would be allowed if a terminal disclaimer were filed.

23. The following is a statement of reasons for the indication of allowable subject matter: it is neither anticipated nor obvious over the prior art of record to have a sputtering process as claimed by Applicant in claim 1.

24. Barnes, US 6,077,403 to Kobayashi et al. (Kobayashi), and US 5,593,551 to Lai each disclose auxiliary magnets, but the magnets are of a polarity perpendicular to the central axis.

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Modifying any of Barnes, Kobayashi, or Lai to have the polarity of the auxiliary magnets parallel to the central axis would involve hindsight.

### *General Information*

For general status inquiries on applications not having received a first action on the merits, please contact the Technology Center 1700 receptionist at (571) 272-1700.

For inquiries involving Recovery of lost papers & cases, sending out missing papers, resetting shortened statutory periods, or for restarting the shortened statutory period for response, please contact Denis Boyd at (571) 272-0992.

For general inquiries such as fees, hours of operation, and employee location, please contact the Technology Center 1700 receptionist at (571) 272-1300.

### *Conclusion*

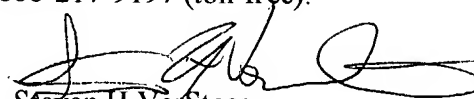
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steven H VerSteeg whose telephone number is (571) 272-1348. The examiner can normally be reached on Mon - Thurs (6:30 AM - 5:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.



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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Steven H VerSteeg  
Primary Examiner  
Art Unit 1753

shv

May 6, 2004